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Provisions for Protecting and Enhancing Nontimber Resources in Northern Region Timber Sales

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RESEARCH SUMMARY

Forest Service timber sales frequently include provisions to protect or improve nontimber resources. But as economic conditions become increasingly restrictive, the costs incurred for nontimber purposes become more closely scrutinized. In order to evaluate the costs and effectiveness of these provisions, it is necessary to identify specific activities and management objectives being served. A questionnaire census of all timber-producing Ranger Districts in the Northern Region was designed to provide that information.

Results indicate that most timber sales incorporate provisions to mitigate harvest impacts (reduce, modify, or eliminate damages) or to enhance and improve resources other than timber. The nontimber resources examined in this study were cultural, fish, range, recreation, soil, visual, water, and wildlife. The nontimber resources most frequently involved are wildlife, soil, and water; least frequently involved, range and cultural resources.

In most cases special provisions are intended to mitigate damage to nontimber resources. In the case of range resources only, provisions for enhancement and mitigation were approximately equal in number.

The Design/Layout and Roads phases of a timber sale are modified most frequently to accommodate nontimber resources, the Loading/Hauling phase least frequently. All provisions for Erosion Control are mitigating, while most provisions in the Structures/Activities phase are enhancing.

The most common specific provisions for nontimber resources are the Location and Size of Cutting Units, together with Road Density and Location. Most specific activities serve more than one nontimber resource. Even some activities commonly associated with management of a specific, single nontimber resource are frequently applied to other resources. For example, Feathered Edge Cutting is closely associated with visual resource management, but is also used for wildlife purposes.

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INTRODUCTION

Forest Service, U.S. Department of Agriculture, timber sales are frequently developed to not only produce timber but also to meet other resource management objectives. A combination of high wood use, rising costs for management activities, and more stringent budgets calls for increased efficiency by managers. The challenge is to increase productivity—to do more for less. Both proponents and opponents of timber harvesting practices have urged greater attention to timber sale costs. But often information is insufficient to allow managers to analyze the costs and benefits.

Some costs are administrative—the result of staffing and maintaining a timber sale program. Other costs are the consequence of managing specific timber sales; the bulk of such costs presumably result from the occasion to sell and harvest timber. Some timber sale costs, however, accrue to nontimber objectives such as improving elk habitat or reducing visual impacts.

Cost-cutting efforts frequently amount to identifying and eliminating nonessential activities—“cutting out the fat.” But for forestry organizations with multiple-use mandates, it is often difficult to distinguish between nonessential fat and essential lean. Some special interest groups oppose spending monies on nontimber resources; others clamor for more attention to such resources. Whether costs associated with nontimber resources are warranted ultimately rests on the value of the benefits produced or not foregone. How much do those nontimber activities cost and are they justified? A thoughtful answer to those questions goes beyond dollar estimates and includes a grasp of the role and scope of provisions for nontimber resources in timber sales. The provisions made for nontimber resources activities must be identified and the extent to which they are incorporated into timber sales must be understood. Furthermore, the purpose of those provisions must be determined since that can substantially affect the manner in which they are handled in an economic analysis. The analysis presented in this report identifies the provisions and describes the frequency with which they affect timber sales, both in the context of specific nontimber resources and the purpose of the provision.

METHODS

Data were collected by means of a mail questionnaire, cooperatively sponsored by the Intermountain Station and the Bureau of Business and Economics Research, University of Montana. A two-part questionnaire (available on request from the authors) was sent to all timber-producing Ranger Districts in the Northern Region of the Forest Service. All Ranger Districts responded; therefore, data and responses amount to population totals, devoid of sampling error. In total, data were obtained from 61 Ranger Districts on 13 National Forests. Most respondents were timber management assistants or District Rangers; the remainder came from various timber staff personnel. Respondents were instructed to restrict their answers to large-volume timber sales: sales of 500 M bd.ft. or more for northern Idaho and western Montana; 100 M bd.ft. for eastern Montana.

The object of the questionnaire was to assess provisions made in timber sales for nontimber purposes. Provisions identified were restricted to those that resulted in a significant modification of the timber sale relative to that where timber production was the only purpose. Respondents were asked to identify the nontimber resource intended to be affected by the provision, as well as the general intended purpose of the provision. The following nontimber resources were included:

Cultural (historical, archeological sites)	Soil
Fish	Visual
Range	Water
Recreation	Wildlife

Provisions were identified without regard as to why (requisiteness) or when (timing within a sale) they occurred. Some provisions identified are mandatory responses to policy requirements. Others are discretionary, involving voluntary choice. Clearly, this distinction can be judgmental. Provisions made in timber sales to meet Regional or Agency-wide standards are mandatory. Habitat protection efforts in compliance with the Endangered Species Act of 1973 might be judged mandatory. Other provisions are discretionary, as might include, for example, cutting stumps flush to the ground

to enhance visual amenities. Similarly, nontimber provisions in the original sale design were not distinguished from those subsequently added to the timber sale award. Provisions can be incorporated while planning the sale, through the Environmental Assessment process, or added while administering the timber sale contract.

Respondents identified only the resources of primary concern. Nevertheless, a given provision almost certainly affected other resources because management activities are so broad and the ecosystem so interconnected. Secondary effects, however, were not identified.

Respondents were asked to identify whether the general purpose of the nontimber provision was for mitigation or enhancement. We define mitigation as follows: to reduce, moderate, or prevent adverse effects on nontimber resources. Our definition of enhancement is: to improve the status of nontimber resources or products relative to presale conditions. Reducing soil erosion from skid trails would be considered mitigation; removing natural stream debris would be considered as enhancing the water resource. The questionnaire asked the purpose of the provision, not the actual outcome. Activities do not always accomplish the desired result, either mitigating or enhancing. Similarly, provisions to mitigate or enhance one nontimber resource may have the opposite, though unintended, effect on another resource.

Respondents were instructed to base replies on their best judgment. While detailed record searches were not requested, reference to records was not disallowed. The alternative of collecting data from a sample of timber sale records (which are readily available) was rejected. Companion research indicated that individual sale records only partially (and then sporadically) address our concerns. They do not provide a comprehensive, synthesized picture of the overall timber sale program. Responses to questions of primary resource affected, significant change, and general purpose of the provision are judgments that fundamentally depend on the perception of the timber manager.

Questionnaire responses were coded and entered into a data file suitable for computer analysis, using SPSS computer programs (Nie and others 1975). All Ranger Districts were assigned to geographical subregions within the Northern Region and data were aggregated by those strata. Figure 1 shows the boundaries of the subregions—northern Idaho, western Montana, and eastern Montana. The Continental Divide is the boundary between eastern and western Montana. Ranger Districts from the National Forests straddling the Divide were assigned to a subregion based on the location of the District Office.

Most questions required response in the form: percentage of sales modified. But because Districts vary in terms of number and size of sale, responses were evaluated under three weighting schemes—sale number, sale volume, and equal weighting. Except for some minor differences, results were virtually the same regardless of weighting system used. The largest differences did not change study results appreciably. Results displayed will be based on only the sale number weighting system. Therefore, study results consist of



Figure 1.—Three subregions of study within Northern Region, Forest Service.

subregional aggregations of District-level responses weighted by the average annual number of large timber sales from 1977 through 1981.

RESULTS AND DISCUSSION

Most of the timber sales in the Northern Region include provisions pertaining to one or more of the eight nontimber resources. The provisions appear to affect virtually all timber sale phases. A wide variety of timber sale activities are undertaken or modified to meet specific objectives. The following sections discuss these three aspects of timber sales and describe geographical and other variations. Please note, although the following results are increasingly specific, they are not nested. Results pertaining to sale activities cannot be aggregated to approximate results for sale phases; phases cannot be aggregated to resources. This is because provisions for several nontimber resources can be made in a single sale.

Nontimber Resources

The first task was to measure the frequency of provisions in timber sales for nontimber resources and whether the provisions were intended to enhance or mitigate. The listing below shows that provisions are frequently made in timber sales for nontimber purposes in the Northern Region.

Nontimber resource	Percent sales with mitigation provisions	Percent sales with enhancement provisions
Cultural	23.2	10.9
Fish	44.1	25.0
Range	14.8	13.0
Recreation	35.0	27.1
Soil	55.8	15.9
Visual	59.2	34.5
Water	66.9	27.0
Wildlife	77.2	54.0

Provisions concerning wildlife were most prevalent—reported in more than three-fourths of the timber sales. Measures affecting soil, water, and visual resources were also common, each occurring on more than half of the sales in the Region. At the other extreme, cultural and range resources affect the fewest sales throughout the Region. The frequencies shown indicate that most timber sales in the Region contain provisions to meet nontimber objectives. Provisions for mitigation greatly outnumber those for enhancement. This is true for every nontimber resource. The high frequency of provisions for each nontimber resource indicates that very few sales would be unaffected.

Figure 2 displays the same type of information, but specifically pertains to the three subregions. It shows considerable differences among nontimber resources. Timber sale provisions for wildlife purposes prevail throughout all subregions, occurring on more than three-fourths of the timber sales. This is to be expected because timber-wildlife relationships are important public issues and the effect on wildlife habitat is always a professional concern. Similarly, the high frequency of provisions for water resources again is expected. Most forest land is water-producing land and timber sales at least afford the potential to alter water quality or quantity along with timing of runoff.

At the other extreme, modifications for range and cultural resources are least frequent. These resources are only occasionally proximate to timber. Furthermore, cultural resources tend to be more concentrated (specific historic sites, trails, etc.) and are not as likely to be affected by timber harvest activities. Therefore, the low levels of activities for these resources probably reflect a less common opportunity rather than a lack of inclination to make timber sale provisions.

There is also considerable geographic variation and similarity in nontimber resources affected. The most striking differences pertain to fish, water, and range resources. Northern Idaho has numerous rivers and streams that are part of the Columbia River system. Timber sale provisions made for fish and water purposes probably reflect concern over the salmon and steelhead fisheries and the importance of water to their well-being. Similarly, range is frequently a concern in the more open forests of eastern Montana. There, forest grazing is much more common than in the more heavily forested areas of western Montana and northern Idaho.

Figure 2 also shows a consistent pattern of mitigation provisions greatly outnumbering enhancement provisions. Excepting range, this is true for every nontimber resource and every geographic area. The greatest difference is for water resources and soil resources, where mitigation provisions outnumber those for enhancement by roughly three to one. For example, although almost 60 percent of the sales in eastern Montana contain mitigation provisions for soils resources, only 10 percent contain enhancement provisions. Provisions are generally intended to protect existing water and to prevent soil erosion. And that gap may be understated, because some respondents indicated difficulty distinguishing between mitigation and enhancement provisions concerning soil resources; some identified enhancement efforts that really amounted to mitigation measures. There are few opportunities to improve soil and water conditions (excepting water quantity) because the natural, undisturbed state is the norm.

In contrast, enhancement and mitigation provisions are approximately equal for range and recreation resources. Perhaps managers believe that timber harvesting improves limited grazing opportunities,

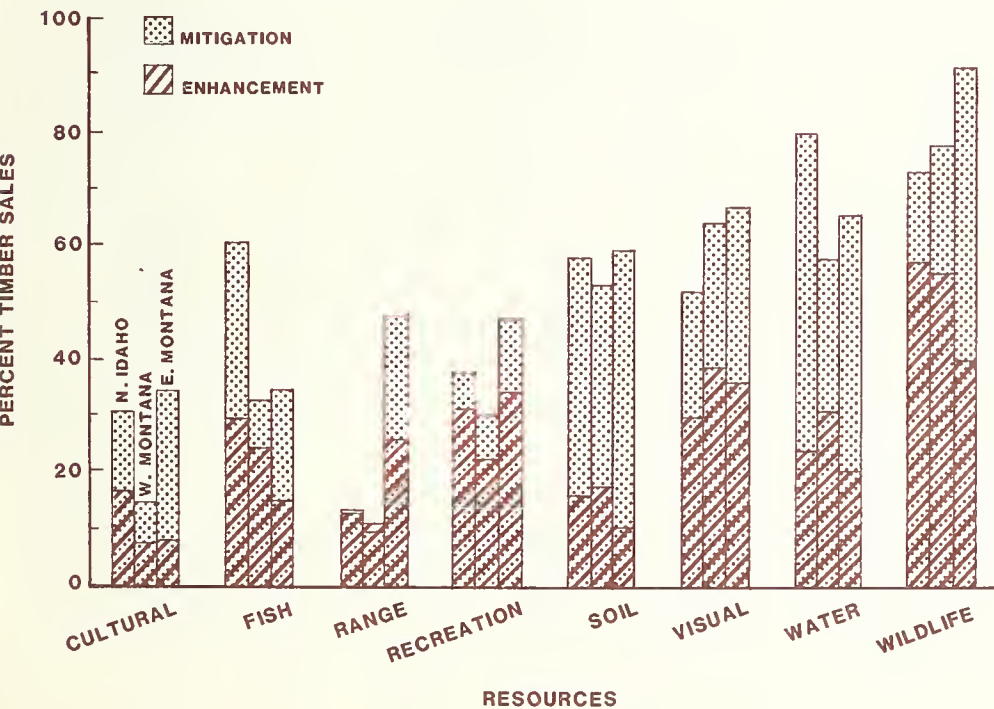


Figure 2.—Percentage of timber sales with provisions to enhance or mitigate for non-timber resources, by resource and subregion.

especially in the more heavily forested areas. Similarly, roads increase access and probably enhance road-dependent recreation activities.

Range resources in eastern Montana and fish resources in northern Idaho show striking deviations from the Regional pattern. The percentage of timber sales modified for range purposes in eastern Montana is more than double that of any other subregion for enhancement, and is even higher for mitigation. In eastern Montana nearly all of the forest land is grazed, unlike other areas in the Northern Region. Similarly, the mitigation provision for fish resources in northern Idaho far exceeds that for other areas. In both cases, this probably reflects both the presence of relatively unique resources and the potential for unacceptable damage through timber sales.

Timber Sale Phases

An important part of understanding how timber sales meet nontimber objectives is to know where within a timber sale the nontimber resource provisions occur. That is, provisions for nontimber resources are decided when planning the sale and later during sale administration. When decisions are implemented, they result in activities that change the nature of the sale. This section focuses on the location of those activities. In order to make results compatible with conventional sale information, activities involved in a timber sale were stratified into eight broad categories or phases, generally following the timber sale appraisal form used by the Forest Service. A "design and layout" category was added to more completely portray the various aspects of a timber

sale. The phases used were:

- | | |
|----------------------------------|------------------------------|
| 1. Sale Design/Layout | 6. Slash Disposal |
| 2. Roads | 7. Erosion Control |
| 3. Felling/Limb-
ing/Bucking | 8. Sale Area
Betterment |
| 4. Yarding/Skid-
ding/Decking | 9. Structures/
Activities |
| 5. Loading/Hauling | |

Decisions to provide for nontimber resources pertain to one of these categories.

The Sale Design/Layout phase was structured to consist of major, overall decisions such as location and size of cutting units and road density. The Roads phase pertains to road construction, reconstruction, and maintenance. The Loading/Hauling phase refers to movement and transport of logs from a log deck or landing to a processing facility. Sale Area Betterment commonly is referred to as "K-V," use of Knutson-Vandenberg funds. Structures/Activities refers to construction and management of temporary structures such as gates or loading ramps as well as road closures or snag felling.

Table 1 provides a Region-wide perspective as to which timber sale phases and nontimber resources are most frequently subject to provisions. As noted previously, timber sale provisions for wildlife and then for soil and water resources clearly dominate other nontimber resources. Provisions made in Sale Design/Layout, along with the Roads are by far the most frequently modified sale phases. Finally, the frequency of provisions designed to mitigate effects totally overwhelm those for enhancement purposes.

Table 1.—Percentage of Northern Region timber sales modified for nontimber purposes, by sale phase, nontimber resource, and purpose

Timber sale phase	Nontimber resource							
	Cul- tural	Fish	Range	Recrea- tion	Soil	Visual	Water	Wild- life
Mitigation Purpose								
Sales Design/Layout	29.3	43.8	13.6	33.0	55.9	56.5	68.2	79.9
Road	18.3	49.5	15.0	35.3	65.4	49.3	63.1	57.9
Felling/Limbing/Bucking	6.7	33.8	6.2	15.6	11.2	23.2	48.2	22.9
Yarding/Skidding/Decking	13.6	48.3	7.5	21.4	54.5	41.2	57.5	33.7
Loading/Hauling	3.3	10.4	5.1	17.0	18.8	10.3	17.7	23.3
Slash Disposal	11.1	35.8	9.4	33.4	42.3	47.6	41.8	49.3
Erosion Control	1.8	43.5	8.1	15.0	65.2	19.2	67.4	19.3
Sale Area Betterment	4.7	29.4	18.7	20.5	26.3	23.7	28.7	62.2
Structures	2.6	9.3	11.7	9.8	10.3	9.7	12.3	56.3
Enhancement Purpose								
Sale Design/Layout	0	5.1	1.1	5.2	6.9	13.4	2.4	6.5
Roads	7.3	22.2	8.3	25.7	22.3	22.8	29.9	28.0
Felling/Limbing/Bucking	4.6	14.0	3.6	6.6	5.4	14.9	18.3	15.1
Yarding/Skidding/Decking	6.6	17.5	5.7	7.8	16.5	24.3	23.3	22.3
Loading/Hauling	1.7	5.7	3.0	7.2	6.4	9.5	10.1	19.3
Slash Disposal	6.3	19.1	7.4	19.4	12.4	31.6	23.2	37.2
Erosion Control	0	0	0	0	0	0	0	0
Sale Area Betterment	2.0	18.4	9.2	4.9	27.0	9.0	27.9	18.8
Structures	7.7	25.0	11.6	29.0	19.9	38.6	32.9	55.9

Figure 3 shows how frequently each timber sale phase is modified and which nontimber resource is involved, and compares subregions. For each resource, a series of histograms, one for each of the nine phases, shows the percentage of timber sales modified to mitigate or enhance that particular resource.

Figure 3 provides for five visual comparisons:

1. A general nontimber resource comparison—an overall comparison of the frequency (height of bars) of modifications from one panel (resource) to another.
2. A comparison of timber sale phases—comparing frequency of modification among sale phases within and between resource panels.
3. Specific resource comparisons—comparing frequency of provision between sale phases, subregions, and resource.
4. Enhancement versus mitigation comparisons—comparing segments of individual bars.
5. Subregional comparisons—comparing the heights of the three bars for each sale phase.

With these comparisons in mind, the following are some of the principal findings.

The first comparison involves the overall heights of bars from one resource panel to another. The overall heights of the bars follow the same general pattern of provisions for nontimber resources shown in table 1 and figure 2. That is, the overall histograms for wildlife and water resources are the highest, and those for cultural and range resources are the lowest.

The second comparison focuses on timber sale phases. Figure 3 shows both a pattern of consistency and of considerable variation. Regardless of nontimber resource area or subregion, the Sale Design/Layout and Roads phases clearly involved the most modification provisions. Conversely, Loading/Hauling had the least. These results probably reflect the inherent opportunities to modify activities for nontimber purposes. Loading/Hauling affords few opportunities, while Roads or Sale Design/Layout affords many. Beyond those generalizations, several unique relationships exist between nontimber resources and sale phase. For example, Erosion Control provisions are very important for water resources, but inconsequential for cultural resources. Similarly, Yarding/Skidding/Decking is quite important for fish resources, but not for range resources except in eastern Montana.

The wildlife resource panel of figure 3 illustrates information available to make resource-specific comparisons. For example, compare the wildlife panel to the cultural resource panel. Note that provisions for wildlife are consistently included in all phases of the timber sale, and in much greater numbers, than for cultural resources. Also, the Sale Design/Layout phase is the component most frequently modified to provide for wildlife resources; the Roads, Sale Area Betterment, and Structures/Activities phases are the next most frequent for sale modification. In general, mitigation provisions greatly outnumber

those for enhancement, with some important exceptions. Specifically, mitigation provisions only slightly outnumber those for enhancement for the Structures/Activities phase in northern Idaho, and enhancement provisions actually exceed those for mitigation in western and eastern Montana. Enhancement provisions also exceed mitigation for Loading/Hauling in western Montana. On the other hand, wildlife provisions made through Erosion Control are usually all mitigating. Finally, although the frequency of wildlife provisions in eastern Montana usually exceeds that for other areas, the relative importance of the various timber sale phases to wildlife provisions is very consistent across subregions.

Comparisons of mitigation provisions and enhancement provisions show two trends. First, Sale Design/Layout and Erosion Control provisions are almost exclusively intended to mitigate. In fact, no enhancement purposes were reported for Erosion Control. This seems particularly reasonable for Erosion Control because it is difficult to envision activities that could be considered enhancing. Second, in Structures/Activities, enhancement provisions almost always outnumber those for mitigation, the dominant exceptions being range resources in northern Idaho and western Montana together with soil and water resources in eastern Montana.

Finally, the information in figure 3 can also be compared geographically. The listing below shows the two most important categories (nontimber resource and sale phase) of modification for each geographic area, for mitigation (M) and enhancement (E):

Northern Idaho:	M	— Wildlife and Sale Design/Layout
		— Water and Erosion Control
	E	— Wildlife and Structures/Activities
		— Visual and Structures/Activities
Western Montana:	M	— Wildlife and Sale Design/Layout
		— Water and Sale Design/Layout
	E	— Wildlife and Structures/Activities
		— Wildlife and Slash Disposal
Eastern Montana:	M	— Wildlife and Sale Design/Layout
		— Wildlife and Roads
	E	— Wildlife and Structures/Activities
		— Recreation and Structures/Activities

The dominant nontimber resources are clearly wildlife and water. The dominant timber sale phases are Sale Design/Layout (for mitigation) and Structures/Activities (for enhancement).

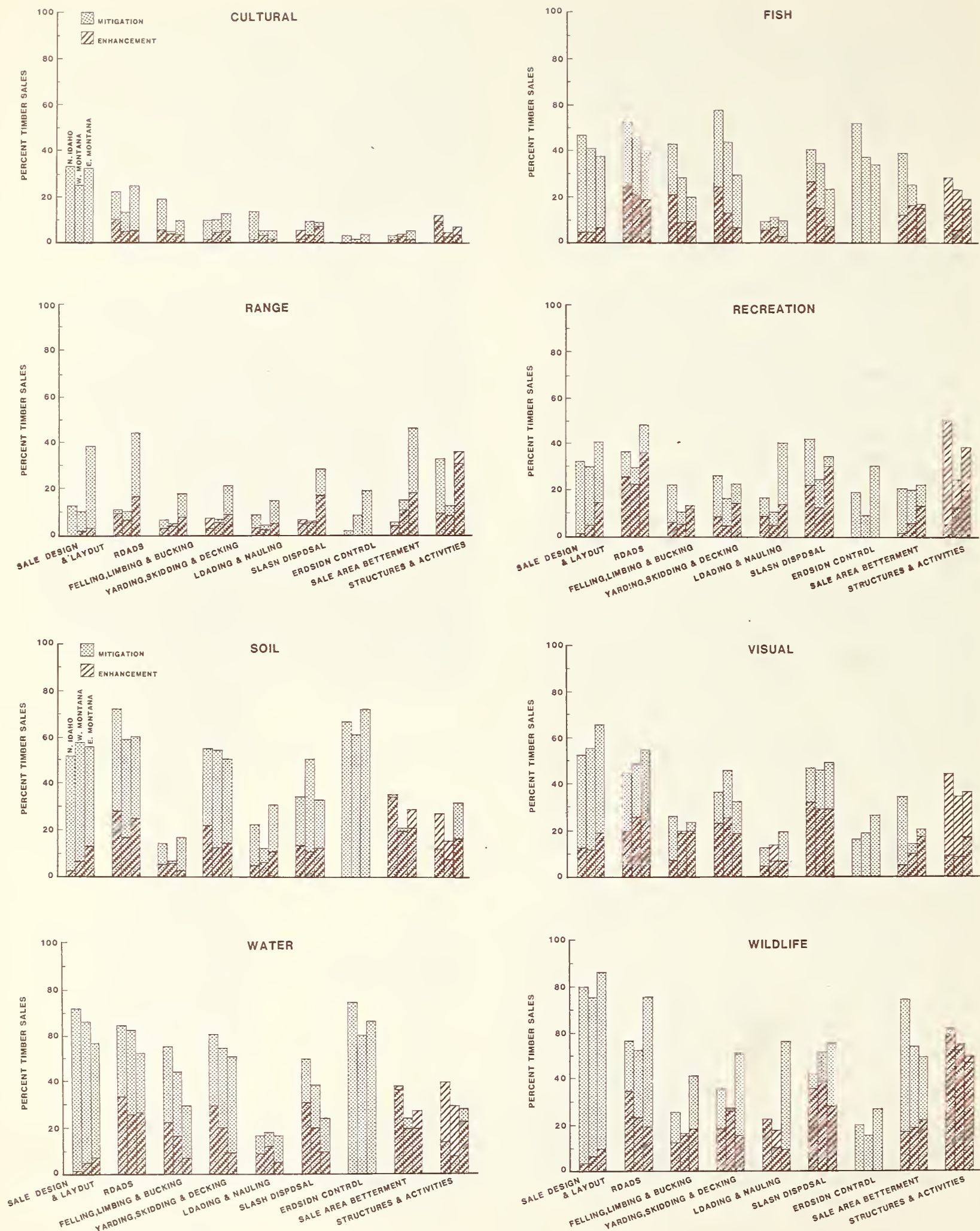


Figure 3.—Percentage of timber sales with provisions to enhance or mitigate for non-timber resources, by resource, timber sale phase, and subregion.

Timber Sale Activities

The final task was to identify timber sale activities used to provide for nontimber resources and to determine their relative frequency of use. Analysis of sale activity at this level of detail required that some supporting information be combined. First, the distinction between provisions for mitigation versus those for enhancement purposes was dropped. It was not practical to obtain that level of detailed response concerning specific activities with a mail questionnaire. Second, whereas preceding results were expressed in terms of percentage of timber sales modified, the following results are summarized by percentage of Ranger Districts in the Northern Region that use specific activities. It was not practical to obtain the detailed information needed to determine the percentage of timber sales incorporating certain activities. We did, however, continue weighting District responses by number of timber sales, to be consistent with the other results reported earlier.

The respondents reported modifying more than four dozen specific activities to provide for nontimber resources. Only about half of these, however, were frequently and consistently used in all geographic areas. The listing below shows a rank ordering of the 10 most widely used practices, over all subregions and nontimber resources:

Timber sale activity	Rank
Location and size of cutting unit	1
Road—density and location	2
Road—seed, mulch, plant	3
Proportion of area harvested	3
Drainage—culverts, ditches, etc.	5
Road alinement and grade	6
Leave strips, streamside cover	7
Yarding/skidding direction and distance	8
Cross-ditch and water-bar skid trails	8
Cleaning trails and streams	8

The first two ranked activities were among the top five activities in more than three-fourths of the subregion-nontimber resource combinations.

Some readers may question the absence of “silvicultural system” and “logging system” in the list above and in the subsequent presentation. There are three possible explanations for this situation. The first explanation is that both items are, in fact, present, but represented by several activities. For example, provisions for nontimber resources via modification in silvicultural system may be reflected in Location and Size of Cutting Unit, Proportion of Area Harvested, Leave Strips, and more. Second, logging systems are not typically specified in a timber sale. But other specifications may limit operator flexibility. For example, variations in Road—Density and Location can substantially affect use of helicopter, cable, or tractor-based systems. Finally, choice of basic silvicultural and logging systems

may be unrelated to nontimber resources. That is, clear-cut may be selected to promote even-aged management and helicopter logging to protect the residual timber stand. If these basic systems are then fine-tuned for nontimber purposes, the result may still fit within the definitional parameters of the original system.

Figure 4 shows how frequently all of the more commonly used activities were cited. The list of specific activities includes only the 25 most frequently cited activities. Many more activities are actually used than are shown. Another 25 activities were also reported, but they were less common and were never among the top 5 activities for a given subregion or nontimber resource. For example, although more than half of the Ranger Districts in northern Idaho and western Montana have provided for wildlife through structures such as gabions and nest boxes, that activity is not within the top five wildlife-oriented activities for either subregion and is not listed in figure 4. Similarly, although firewood gathering is common, special firewood provisions were uncommon in timber sales.

The heavy shading in figure 4 indicates that specific activities relating to the Sale Design/Layout phase (first three activities) are the most frequently used. That phase includes decisions pertaining to area harvested and area and location of cutting units. Similarly, specific activities related to road density and location are also important. These activities all affect size of area treated, a major consideration in providing for nontimber resources. Activities pertaining to the Roads phase, such as installation of culverts or seeding roadways, are also very commonly used.

Results shown in figure 4 suggest a relationship between pervasiveness of use and pervasiveness of effects. Activities that have widespread use tend to have widespread consequences. Activities having limited use have limited consequences. For example, provisions are made for all nontimber resources through the Location and Size of Cutting Units activity; and at the same time, the consequences of those provisions are far-reaching. On the other hand, Seeding and Planting for Wildlife is much less frequently used and its consequences are much more restricted.

Specific activities are rarely used exclusively for only one nontimber resource. This is shown in figure 4 by the presence of shading across nontimber resources for almost all activities. Usually a given activity can be used to provide for any of several nontimber resources. For example, except for range resources, the impacts of Road Density and Location are commonly considered for all other nontimber resources. Even “Feathered Edge” cutting, which is generally considered to be a visual management technique, is frequently used to manage wildlife in northern Idaho. But figure 4 includes just the top five activities for each nontimber resource and subregion combination. If all activities were included, there would probably be a greater occurrence of single-resource activities.

RESOURCE

SPECIFIC TIMBER SALE ACTIVITIES	CULTURAL			FISH			RANGE			RECREATION			SOIL			VISUAL			WATER			WILDLIFE		
	N	W	E	N	W	E	N	W	E	N	W	E	N	W	E	N	W	E	N	W	E	N	W	E
	ID	MT	MT	ID	MT	MT	ID	MT	MT	ID	MT	MT	ID	MT	MT	ID	MT	MT	ID	MT	MT	ID	MT	MT
LOCATION AND SIZE OF CUTTING UNITS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ROAD DENSITY AND LOCATION	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PROPORTION OF SALE AREA HARVESTED	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ROAD ALIGNMENT AND GRADE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ROAD DRAINAGE--DITCHES,CULVERTS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ROADWAY SEED,MULCH,PLANT	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ROAD MAINT.--GRADING,CLEANDITCHES	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
DIRECTIONAL FELLING	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
STUMP HEIGHT & SLOPE CUTTING	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
"FEATHERED EDGE" CUTTING BOUNDARY	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
LEAVE TREES,WILDLIFE TREES	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
LEAVE STRIPS,STREAM SIDE COVER	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
YARDING/SKIDDING DIR. & DIST. SPECS.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
HAUL RESTRICTIONS--SEASON,WEEKEND	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
DUST CONTROL	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
LOPPING & SCATTERING SLASH	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
CLEAN SLASH FROM TRAILS & STREAMS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SLASH BURN--PILE SIZE,ROWS,ETC.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
CROSSDITCH & WATER BAR SKID TRAILS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SEEDING SKID TRAILS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
UNDERBURN FOR WILDLIFE HABITAT	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SEED & PLANT FOR WILDLIFE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
GATES AND FENCES	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PUBLIC ACCESS--CLOSURES	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
"USER STRUCTURES" --TRAILHEADS,SIGNS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

KEY :

■ 76-100%

■ 51-75

■ 26-50

■ 1-25

■ 0

Figure 4.—Percentage of Ranger Districts using specific timber sale activities as provisions for nontimber resources, by resource and subregion.

MANAGEMENT IMPLICATIONS

The previous sections have highlighted several important aspects of timber sale provisions for nontimber purposes. Various issues were addressed. Which nontimber resources are most commonly the target of timber sale provisions? Was the provision intended to mitigate or enhance those resources? Which phase(s) within the timber sale do the provisions involve? What forms—specific activities—do timber sale provisions take? Variations in these issues resulting from geographical considerations were also discussed. The purpose was to provide a preliminary basis on which to deal with efficiency and cost effectiveness in timber sale design.

It is important to recognize the legitimate distinction between timber sale provisions made for mitigation and enhancement purposes and to treat them properly in any economic analysis. Costs incurred for mitigation activities are rightfully assigned to the timber resource. Presumably, without these activities, nontimber resource production would be lowered; the value of these reduced levels would be assessed in economic analysis of the timber sale. Whether or not the mitigation costs incurred (to prevent loss) are less than, equal to, or greater than the value of the loss is a separate question. Costs incurred and values gained from resource enhancement could be analyzed separately if desired. These activities and their costs could be conceived as independent production processes and evaluated accordingly.

Whether or not costs borne for nontimber purposes are warranted ultimately rests on the magnitude of the benefits received or not foregone. Our results do not indicate magnitude of costs and should not be so interpreted. We have measured the frequency of timber sale

modifications only. Frequently applied modifications may, for example, be relatively inexpensive or have little impact compared to modifications that are infrequently applied, or vice versa. We simply do not know.

Even though estimation of dollar costs was beyond the scope of research reported here, results disclose two factors that profoundly influence costs. The most common provisions to modify timber sales are related to sale size. Such provisions directly affect harvesting costs and product recovery. The second most common provisions to modify a sale are related to roads. Because roads are one of the most expensive aspects of forest management, there is a high likelihood of substantial cost implications. Roads widely spaced to benefit wildlife might substantially reduce road construction costs, but increase yarding costs.

Results of this study indicate that most timber sales are affected by provisions for nontimber resources. Results also indicate where these provisions are made and for what purpose. The next step would be to estimate these costs and compare them to output. Measuring costs is difficult. But associating costs with specific nontimber resources will be even more difficult because, as shown, many provisions serve several target resources and probably affect others as well.

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Timber sale provisions to mitigate impacts on or enhance nontimber resources are discussed for the Northern Region, Forest Service. Data were obtained by questionnaire. Wildlife, soil, and water resources were the most frequent concerns. Special provisions were usually incorporated into design and layout of the sale and roads, and typically protect, not enhance, nontimber resources.

KEYWORDS: timber sales, nontimber resources, costs, economic analysis

The Intermountain Station, headquartered in Ogden, Utah, is one of eight regional experiment stations charged with providing scientific knowledge to help resource managers meet human needs and protect forest and range ecosystems.

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